

REMARKS

Introduction

The present Amendment is in response to the Office Action mailed October 1, 2004. The Office Action rejected claims 1-27 and 29-34. Reconsideration of the application is respectfully requested in view of the following remarks. Please note that the following remarks are not intended to be an exhaustive enumeration of the distinctions between any cited references and the claimed invention. Rather, the distinctions identified and discussed below are presented solely by way of example to illustrate some of the differences between the claimed invention and the cited references. In addition, Applicants request that the Examiner carefully review any references discussed below to ensure that Applicants understanding and discussion of the references, if any, is consistent with the Examiner's understanding. For the Examiner's convenience and reference, Applicant's remarks are presented in the order in which the corresponding issues were raised in the Office Action.

Claim Rejections Under 35 U.S.C. § 103

The Office Action rejected claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,046,096 (Ouchi) in view of U.S. Patent No. 6,008,525 (Barron). Claims 2, 8, 14, 20, 26, and 30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ouchi in view of Barron and further in view of U.S. Patent No. 5,832,018 (Ohkubo). The independent claims 1, 25, and 33 have been rejected over Ouchi in view of Barron.

A *prima facie* case of obviousness must satisfy three basic criteria. First, there must be some suggestion or motivation to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference or references must teach or suggest all the claim limitations. See MPEP 2143. The following discussion illustrates that the *prima facie* case of obviousness is not satisfied for the pending claims.

Rejection of Claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 under § 103(a)

Regarding claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34, the Office Action suggests that Ouchi shows an active region comprising one 5 nm thick InGaAsSbN quantum well. The portion of Ouchi cited by the Office Action, however, merely recites that

“In the first and second embodiments, InGaAsN is fabricated by nitrifying InGaAs However, other III-V semiconductors can be used. In this case, In, Ga and Al can be used as III-group element, Sb, As, and P can be used as element of V group, and the element of V group is partly substituted by N by the nitrification process.” See col. 9, lines 31-36.

In view of this teaching, Applicants believe that the Office Action is applying an improper “obvious to try” standard as described in MPEP § 2145 (X)(B), which is not allowed. The MPEP § 2145 (X)(B) states this error can occur where “the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.” See MPEP § 2145(X)(B).

In this case, the Ouchi reference does not teach “at least one quantum well comprised of InGaAsSbN, as required by claim 1. Instead, Ouchi has only provided numerous possible element choices from group III and group V as stated above.

Regarding the numerous possible element choices identified by Ouchi, there is no indication of which parameters are critical for a successful vertical cavity surface emitting laser. Regarding a quantum well comprised of InGaAsSbN as required by claim 1, for example, the specification indicates that the use of Sb in the quantum well can reduce the band gap energy further, while avoiding the type II behavior (allowing even more nitrogen). See page 18, lines 27-29. Further, the specification indicates that the use of Nitrogen in the quantum wells can make the valence band discontinuity nonconfining or type 2. See page 18, lines 1-2. If Sb replaces a portion of the As in the quantum well, the type II transition caused by nitrogen can be further be avoided allowing even more nitrogen. Because more nitrogen is allowable, more indium is also allowable. Because nitrogen, indium, and Sb all reduce the band gap energy, the achievable wavelengths extend to longer wavelengths. See page 18, lines 1-10.

In contrast, Ouchi only teaches that with these elements, "a semiconductor film, whose energy band gap varies in a wide range, can be formed." See col. 9, lines 37-38. Ouchi does not specify the parameters that indicate which of the group III and group V elements should be selected for an active region. For example, Ouchi does not specifically identify what band gap is achievable using various combinations of the Group III-V elements. Ouchi does not teach that the use of Nitrogen can make the valence band discontinuity nonconfining or type 2. Ouchi does not teach that Sb can replace a portion of the As in the quantum well. In other words, Ouchi has identified nitrification in an InGaAsN/GaAs active region, and then suggests that other group III-V elements can be used without identifying critical parameters.

As a result, using Ouchi to reject claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 is improper for at least these reasons.

The Office Action further rejects claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 by alleging that Ouchi teaches AlGaAs barrier layers by citing col. 1, lines 35-36 and col. 7, lines 14-65. With regard, to col. 1, lines 35-36, this portion only teaches the combination of InGaAsN quantum well layers with AlGaAs barrier layers. In contrast, claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 require InGaAsSbN quantum well layers. Thus, the combination of InGaAsN quantum well layers with AlGaAs barrier layers described in col. 1 lines 35-36 does not suggest InGaAsSbN quantum well layers as required by claims 1; 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34.

Similarly, Applicants review of col. 7, lines 14-65 does not reveal AlGaAs barrier layers for InGaAsSbN quantum well layers. In fact, col. 7, lines 14-65 does not mention AlGaAs barrier layers. Instead, Ouchi discloses an undoped GaAs barrier layer and an undoped InGaAs layer that is nitrified to form an InGaAsN quantum well layer. See col. 7, lines 53-57. Thus, the rejection of claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 is improper for at least these reasons.

The Office Action next recited that Ouchi lacks AlGaAs confinement layers, but that Barron teaches AlGaAs confinement layers. The specification of the invention states that "quantum wells for VCSELS should be designed to promote confinement of carriers within the quantum wells instead of outside of the quantum wells. See page 21, lines 20-22. The effect of promoting confinement of carriers within the quantum wells is further illustrated in the Figures 14-22, which illustrate VCSEL behavior at different well depths. In particular, Figure 15 illustrates that "there is little recombination outside the

three quantum wells shown.” See page 22, lines 18-19. Figure 18 shows an “increasing number of holes and electrons 1811 outside the three quantum wells. Such loss of holes and electrons outside of the quantum wells results in less luminescence 1901 and, therefore less gain resulting from the quantum wells.” See page 23, lines 1-5.

In other words, recombination of carriers is to be confined to the quantum wells and not the confinement layers. In contrast, Barron teaches that “the light emission from such a structure originates from both within the active InGaAs layer and to a much greater extent from the surrounding AlGaAs/GaAs confinement layer.” See col. 5, lines 26-28. Barron teaches that light emission is greater in the confinement layers. As a result, the confinement layers required by claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 are not taught or suggested by Barron.

For at least the reasons discussed above, claims 1, 3-7, 9-13, 15-19, 21-25, 27, 29, and 31-34 are believed to overcome the art or record and allowance is respectfully requested.

Rejection of Claims 2, 8, 14, 20, 26, and 30 under § 103(a)

Claims 2, 8, 14, 20, 26, and 30 are rejected as being unpatentable over Ouchi in view of Barron and further in view of Ohkubo. For the reasons discussed above, the independent claims 1, and 25 overcome the cited art and are believed to be in condition for allowance. Further, Ohkubo does not disclose an active region with at least one quantum well comprised of InGaAsSbN as required by claims 1 and 25. For at least these reasons and because claims 2, 8, 14, and 20 depend from claim 1 and claims 26

and 30 depend from claim 25, claims 2, 8, 14, 20, 26, and 30 are believed to be in condition for allowance.

Conclusion

In the event that the Examiner finds remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview, the Examiner is requested to contact the undersigned attorney.

Dated this 30th day of December 2004.

Respectfully submitted,



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